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Canadian tool computes impact of missing your medicine

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"Just a spoonful of sugar," crooned Mary Poppins, "and the medicine goes down." Fact is, quite often the medicine doesn't go down. Human nature being what it is, people often miss taking a dose - for all sorts of reasons. Just how risky is that? What sort of damage could it cause? A tool developed by researchers at the University of Montréal can determine all that with a great deal of accuracy.

"I forgot to take it" or "I feel so much better now, I think I'll skip" are two common excuses people utter when they miss taking prescribed medication. For some individuals the effects of a skipped dose could mean a few more days of the sniffles.

For other less fortunate patients, the oversight could lead to more serious complications such as cardiovascular disorders or the rejection of a transplanted organ.

Researchers at the University of Montréal in Quebec are using graphical simulation and high performance computing software to develop tools that help clinicians and caregivers determine the parameters within which patients can safely miss their medication.

Different drugs have different properties and patient reaction to medication and their individual behaviour is often difficult to predict, noted Fahima Nekka, a professor in the Faculty of Pharmacy at the University of Montréal (UM). She said such a tool can greatly reduce the incidence of complications or deaths due to prescription non-conformance.

Nekka, her collaborator Jun Li and several UM graduates are using mathematical computations to evaluate the impact of factors such as drug attributes, time deviations and missing doses on the maintenance of drug efficacy.

Their work is among the projects funded and supported by the Mathematics of Information Technology and Complex Systems (MITACS) a federally funded research network hosted by the Simon Fraser University in Burnaby, B.C.

The project is one of those that will be highlighted at the Second Canada-France Congress, a gathering of the world's top mathematicians to be held from June 1 - 5 in Montreal.

Currently healthcare workers rely on metrics based on calculations of a medicine's prescribed dosage to determine the safe parameters, said Nekka. For example, for a prescription of 100 tablets of a certain medicine, 80 per cent compliance might be considered safe but anything less could put a patient at risk. This method is not accurate, because many factors determine the safety threshold such as patient reaction, and the varying makeup of drugs even within a specific classification, said the UM professor.

"Some drugs may be more forgiving that others when a dosage is missed. It's not the number of pills taken but the therapeutic action that counts."

To tackle the complex mathematical calculations and simulations involved in the project, the team used MatLab, a computational and modeling application developed by MathWorks Inc., a software development firm based in Natick, Mass. The tool is used in computational biology, diagnostic imaging and biosignal processing. It helps researchers create models for analyzing drug dosage and visualizing complex biological data or even human organs and physiological systems and their potential reactions.

Projects such as those developed by Nekka's team will hopefully change the perception that mathematics is an abstract discipline removed from everyday life, said Arvind Gupta, scientific director of MITACS.

Gupta believes encouraging projects such as this will help Canada gain prominence in technology despite the growing trend to outsource many IT jobs to other countries. "Technology is being turned into a commodity as more IT projects are outsourced. We can still gain the upper hand if Canadians focus on research and development rather than manufacturing."

He likened this strategy to that adopted by many U.S. automotive design firms. When manufacturing of automobiles and auto parts shifted to other countries, innovative firms concentrated on automotive design. "Today, many makers of imported cars want their products designed in California".

The healthcare sector, he said, adopts a range of technologies used in other industries. Many researchers use business intelligence (BI) tools to gather and analyze health-related data.

For instance, researchers at the Brock University in St. Catherine's, Ont., are using BI software from SAS Institute to crunch through massive amounts of social, genetic and biological data from more than 2,000 patients. The application is helping researchers study long-term survival of some breast cancer patients in the hopes of developing better treatment strategies.

Although BI technology has been very useful in the corporate world, the technology lends itself to he medical research realm as well, according to one Toronto-based analyst

"The process of mining data from various sources and analyzing it remains the same, only context has changed," according to Carmi Levy, senior vice-president of consulting firm AR Communications Inc. in Toronto.

Tools such as SAS BI software and MatLab "enable researchers to find the needle in the haystack, the useful knowledge residing in the stacks of data."

Other projects funded by MITACS include:

- Research by Leon Glass of McGill University cardiac arrhythmias. Cardiac arrhythmias can lead to physical impairment, stroke and sudden death. Glass is using mathematic to provide new insights into abnormal heart rhythms and their prevention.

- A project led by Dr. Matt Davison from the University of Western Ontario. Davison is a developing new financial tool to help traders in the financial and commodity markets make better trading decisions.

- A project for locating oil reserves. Michael Lamoureux and Gary Margrave from the University of Calgary are leading a team which is using mathematics and geophysics to improve seismic imaging techniques that create accurate images of the earth.